man's comments on structural formulae are apposite. Von Knorring and I assumed a brucite impurity but admitted the slender nature of the evidence, McConnell invoked tetrahedral hydroxyl groups and Zussman now shows this concept can be variously applied; he also considers "a different and hardly less justifiable assumption" that 2.3% of the 15.03% of H_2O+ should be treated as an impurity. This later suggestion appears to be just about as arbitrary as our brucite suggestion and it is scarcely strengthened by the Fe atoms going wholly into tetrahedral positions. What emerges most clearly from these discussions is that structural formulae are difficult to determine reliably when departures from normality arise. Under such circumstances, it is obviously desirable to survey the problem from a variety of points of view before attaching much weight to an unusual formula arrived at from one set of assumptions.

G. W. BRINDLEY

NOVACEKITE FROM THE WICHITA MOUNTAINS, OKLAHOMA

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Novacekite, $Mg(UO_2)_2(AsO_4)_2 \cdot nH_2O$, described by Frondel (1951) from Schneeberg, Saxony, has been identified from the Wichita Mountains in Southwest Oklahoma. This member of the torbernite group was first found in October 1952 by Earl Smith, in Permian Red Beds and recent sedimentary deposits in SE $\frac{1}{4}$, SE $\frac{1}{4}$ Sec. 23, T. 3 N., R. 14 W., when the writer accompanied him in selecting a problem for his Master's thesis in the Wichita Mountains. Later, in April 1953 novacekite was again found in a friable red sandstone, $\frac{1}{2}$ mile northwest of Twin Mountain, while the writer undertook the investigation of the Wichita Mountains igneous complex. Small cavities of the sandstone are filled with novacekite crystals along with limonite, malachite, calcite and quartz grains. The occurrences of novacekite in sandstone are reminiscent of that recently described by Stern and Annell (1954). They found the same mineral from the Woodrow area, Laguna Reservation, Valencia County, New Mexico. The novacekite coats a somewhat iron-stained friable sandstone in the Westwater Canyon sandstone member of the Morrison formation of Jurassic age.

Novacekite forms a series with saléeite, $Mg(UO_2)_2(PO_4)_2 \cdot 10H_2O$, its phosphate analogue. Frondel divides this phosphate-arsenate series and applies the species names saléeite and novacekite to the halves of the series with $P > As$ and $As > P$, respectively, in atomic per cent. The speci-

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men collected by Smith is somewhat altered and is coated with impurities. The amount of material present in the specimen found by the writer was insufficient for a quantitative chemical analysis. However, a semi-quantitative spectrographic analysis of the Oklahoma novacekite indicated As_2O_5 in the greater-than-10 per cent bracket, but P_2O_5 was not observed in any bracket down to a sensitivity limit to 0.1 per cent.

The novacekite is straw yellow in color. Euhedral crystals are rectangular in shape. The basal cleavage is perfect and luster is waxy. The specific gravity is 3.66.

X-ray studies showed this novackeite to be tetragonal. The unit cell dimensions are: $a_0 = 7.18$ Å, $c_0 = 20.16$ Å. Thus, the *x*-ray powder pattern of novacekite differs from the patterns of saléeite and arsenatian saléeite only by its slightly larger unit cell dimensions. (The unit cell dimensions of arsenatian saléeite are: $a_0 = 7.05$ Å, $c_0 = 19.87$ Å.)

Optically this mineral is anomalously biaxial with $(-)2V_D = 5°–18°$. Indices of refraction for *D* light at 25° C. are: $\alpha = 1.624$, $\beta = \gamma = 1.640$. Pleochroism is weak: X = nearly colorless, Y = Z = yellow to pale yellow. The mineral fluoresces bright straw yellow to lemon yellow in both short and long wave-length ultraviolet radiation, though the intensity of the fluorescence is somewhat less in short wave-length than in long wave-length radiation.

The writer wishes to express this appreciation to Mr. Earl Smith, graduate student of the University of Oklahoma, for the specimen that he contributed to this investigation, and to Professor Earl T. Apfel, Director of Geo-Research at Syracuse University Research Institute, who kindly read the manuscript.

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AN UNUSUAL PALAGONITE TUFF

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About a decade ago a fine-grained, black rock specimen was submitted to the laboratories of the Bureau of Reclamation, U. S. Department of the Interior, Denver, Colorado. The hand specimen had a satin-like luster and conchoidal fracture, giving it the appearance of cannel coal. It came from a complex series of flows and beds of volcanic origin, $6\frac{1}{2}$ miles east of Vantage, Washington. According to Dr. Wiliam H. Irwin, who later